Introduction to GIS Mapping

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Exercise 1	Introduction to the ArcMap Interface
Exercise 2	Adding Data to the Mapping Display
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Exercise 7	Exporting Data & Making Maps

Module Introduction

Overview

This module give an introduction of the ArcMap interface. ArcMap is the premier application for desktop geographic information systems (GIS) and mapping. ArcMap gives you the power to:

- **Visualize**—You'll be working with your data geographically: seeing patterns you couldn't see before, revealing hidden trends and distributions, and gaining new insights.
- **Create**—It's easy to create maps to convey your message. ArcMap provides all the tools you need to put your data on a map and display it in an effective manner.
- **Solve**—Working geographically lets you answer questions such as "Where is...?," "How much...?," and "What if...?" Understanding these relationships will help you make better decisions.
- **Present**—Showing the results of your work is easy. You can make great-looking, publication-quality maps and create interactive displays that link reports, graphs, tables, drawings, photographs, and other elements to your data. You'll find that communicating geographically is a powerful way to inform and motivate others.
- **Develop**—The ArcMap customization environment lets you tailor the interface to suit your needs, build new tools to automate your work, and develop standalone applications based on ArcMap mapping components.

Tools and Technology

ArcGIS Components

- ArcMap
- ArcCatalog

Skills Learned

- Understand types of spatial data
- Understand GIS terminology
- Understand the ArcMap interface
- Be able to use the various menus and tools available in ArcMap

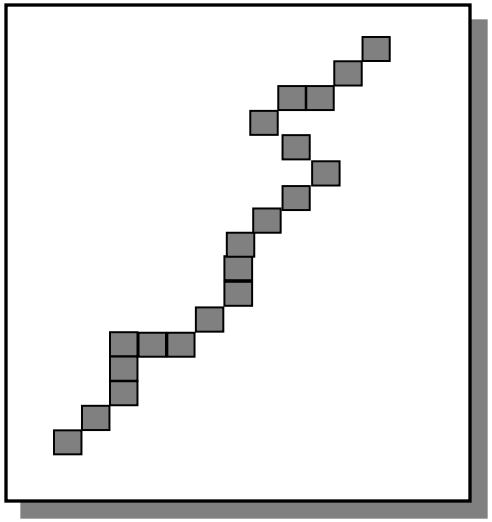
Introduction: GIS Theory

Vector Data sets

- A representation of a spatial phenomenon as a series of points, lines, or areas
- Points are referenced to a spatial coordinate system, lines to points, and areas to their lines
- Each entity has an ID, which is linked to attribute data in a separate database file

Raster Data sets

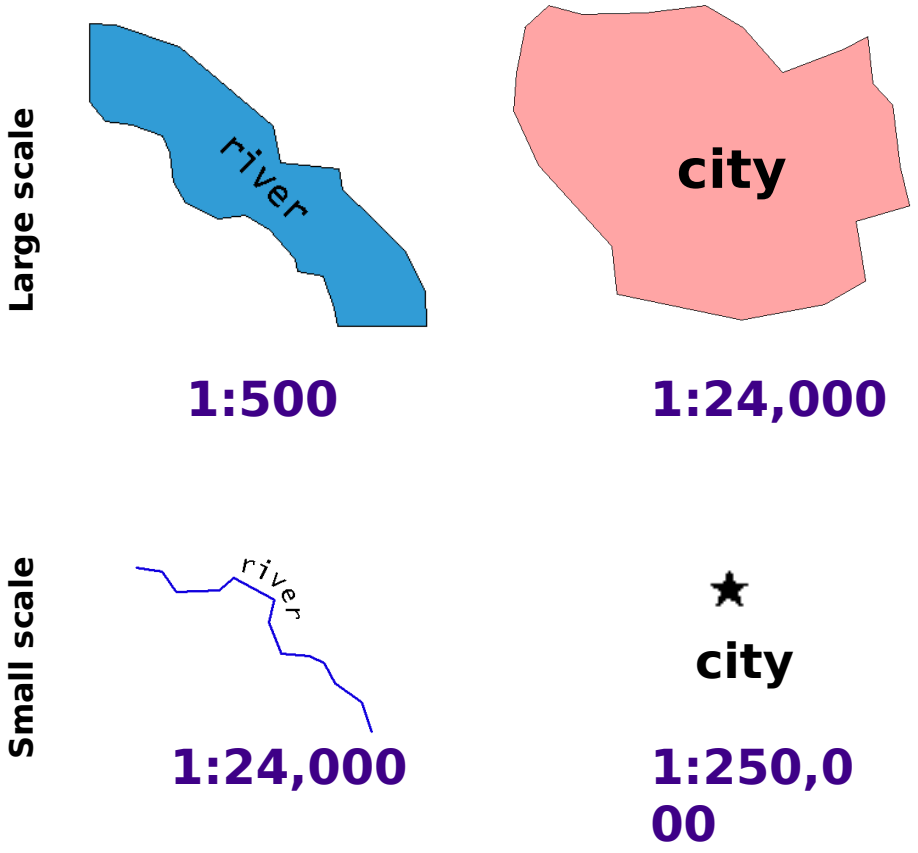
- A representation of a spatial phenomenon as a series of grid cells, or pixels
- Point phenomena are represented as single cells, lines as a series of connected cells, and areas as groups of connecting cells
- Each pixel has an associated value or array of values



Introduction: GIS Theory

Scale

- Remember, spatial data sets are only representations of real-world phenomena
- Scale determines the size and shape of features in a GIS
- At larger scales, many spatial phenomena are represented as areas
- As you decrease the scale of the map, many phenomena are represented as points or lines



Introduction: Spatial Data Formats

Spatial Data can be acquired in a variety of formats, such as MS Word documents, Adobe PDF, MS Excel, ASCII text files, ESRI shapefiles or feature classes, etc. However, when working with an enterprise GIS system, the best way to acquire spatial data is in a GIS compatible formats. Some of these formats include:

-Comma-delimited text files (ASCII text)

-Microsoft Excel Spreadsheets

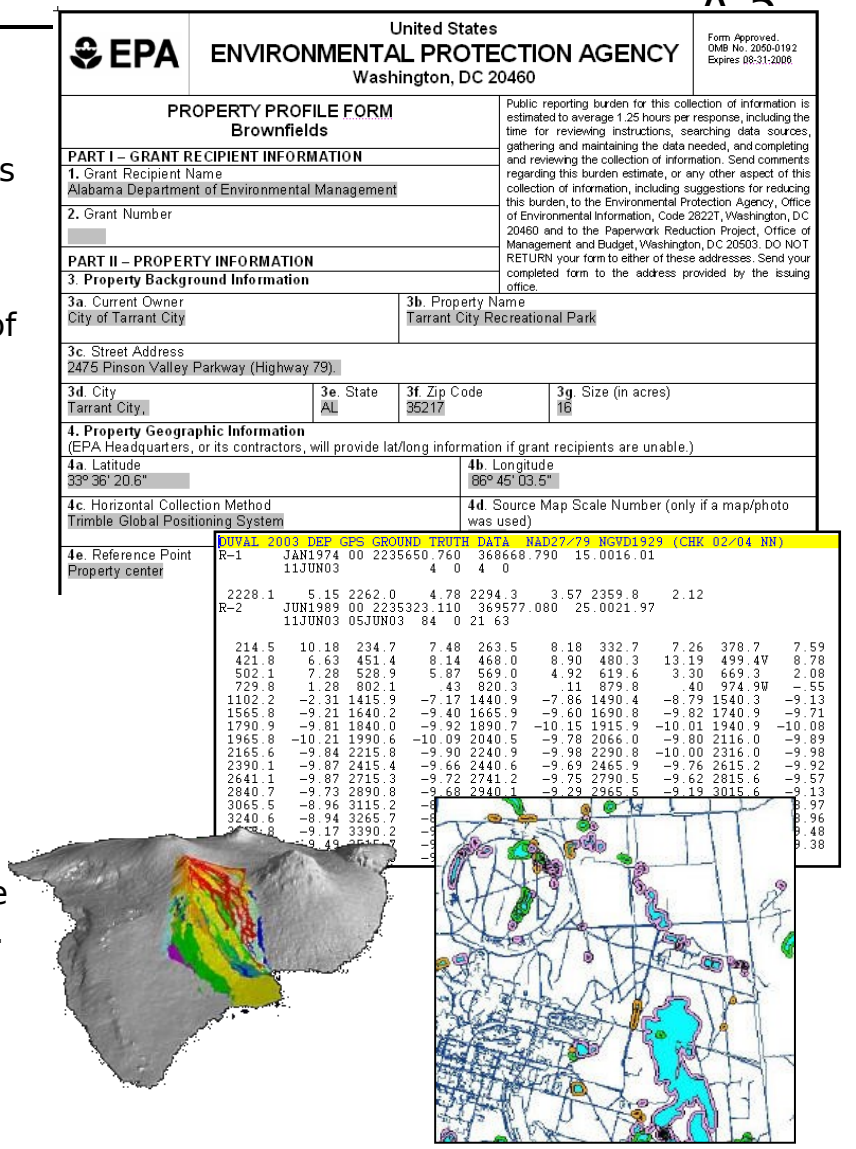
-Microsoft Access Databases

-ESRI shapefiles or geodatabase feature classes

-Raster data in .tif, .tiff, .jpg, .jp2, .img, .sid with accompanying world files.

If data is not collected in one of the above formats, it requires more data editing to transform the data into a compatible file.

The US Army Corps of Engineers has adopted the ESRI suite of products to support GIS analysis and spatial data editing. To utilize and have access to all of the tools contained eCoastal and ESRI's ArcMap on the whole, data must be compatible with the software.



EPA — United States ENVIRONMENTAL PROTECTION AGENCY, Washington, DC 20460

Form Approved. OMB No. 2050-0192 Expires 08-31-2006

PROPERTY PROFILE FORM
Brownfields

Public reporting burden for this collection of information is estimated to average 1.25 hours per response, including the time for reviewing instructions, searching data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate, or any other aspect of this collection of information, including suggestions for reducing this burden, to the Environmental Protection Agency, Office of Environmental Information, Code 2822T, Washington, DC 20460 and to the Paperwork Reduction Project, Office of Management and Budget, Washington, DC 20503. DO NOT RETURN your form to either of these addresses. Send your completed form to the address provided by the issuing office.

PART I – GRANT RECIPIENT INFORMATION

1. Grant Recipient Name: Alabama Department of Environmental Management

2. Grant Number:

PART II – PROPERTY INFORMATION

3. Property Background Information

3a. Current Owner: City of Tarrant City

3b. Property Name: Tarrant City Recreational Park

3c. Street Address: 2475 Pinson Valley Parkway (Highway 79).

3d. City: Tarrant City,

3e. State: AL

3f. Zip Code: 35217

3g. Size (in acres): 16

4. Property Geographic Information
(EPA Headquarters, or its contractors, will provide lat/long information if grant recipients are unable.)

4a. Latitude: 33° 36' 20.6"

4b. Longitude: 86° 45' 03.5"

4c. Horizontal Collection Method: Trimble Global Positioning System

4d. Source Map Scale Number (only if a map/photo was used)

4e. Reference Point: Property center

DUVAL 2003 DEP GPS GROUND TRUTH DATA NAD27/79 NGVD1929 (CHK 02/04 NN)

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         11JUN03             4   0   4   0

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R-2      JUN1989 00 2235323.110  369577.080   25.0021.97
         11JUN03 05JUN03  84   0 21 63

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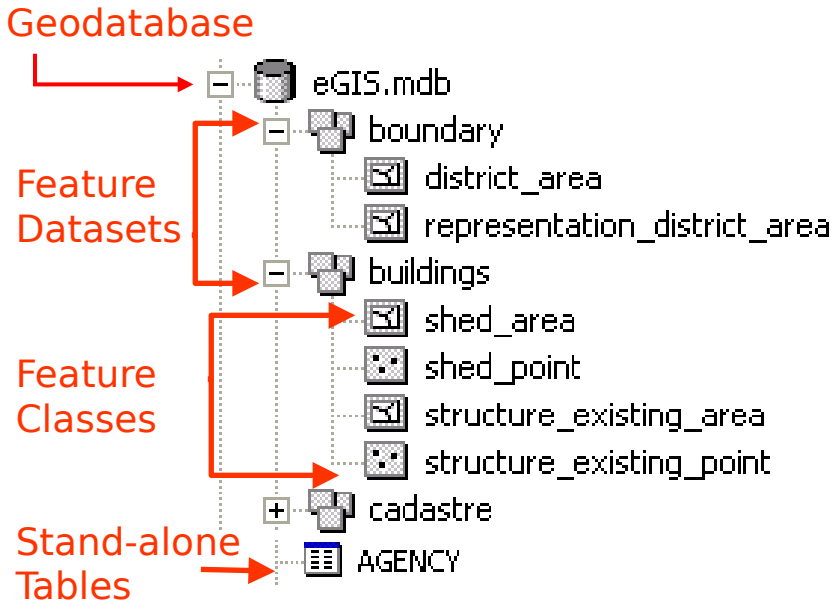
  421.8    6.63  451.4    8.14  468.0    8.90  480.3   13.19  499.4W   8.78
  502.1    7.28  528.9    5.87  569.0    4.92  619.6    3.30  669.3    2.08
  729.8    1.28  802.1     .43  820.3     .11  879.8     .40  974.9W   -.55
 1102.2   -2.31 1415.9   -7.17 1440.9   -7.86 1490.4   -8.79 1540.3   -9.13
 1565.8   -9.21 1640.2   -9.40 1665.9   -9.60 1690.8   -9.82 1740.9   -9.71
 1790.9   -9.81 1840.0   -9.92 1890.7  -10.15 1915.9  -10.01 1940.9  -10.08
 1965.8  -10.21 1990.6  -10.09 2040.5   -9.78 2066.0   -9.80 2116.0   -9.89
 2165.6   -9.84 2215.8   -9.90 2240.9   -9.98 2290.8  -10.00 2316.0   -9.98
 2390.1   -9.87 2415.4   -9.66 2440.6   -9.69 2465.9   -9.76 2615.2   -9.92
 2641.1   -9.87 2715.3   -9.72 2741.2   -9.75 2790.5   -9.62 2815.6   -9.57
 2840.7   -9.73 2890.8   -9.68 2940.1   -9.29 2965.5   -9.19 3015.6   -9.13
 3065.5   -8.96 3115.2   -8
 3240.6   -8.94 3265.7   -8
 3290.8   -9.17 3390.2   -9
 3415.7   -9.49 3515.7   -9
```

Introduction: Data Storage

The Geodatabase

A Geodatabase is a proprietary (ESRI/ArcGIS) storage format that represents geographic features and attributes as objects and is hosted inside a relational database management system. It is organized into a variety of feature datasets and sub-divided into feature classes, as defined by the ***Spatial Data Standard***.

- Enterprise Level
  - SQL, ORACLE format
  - Allows for raster data and vector data storage
  - Requires ArcSDE for management, ArcEditor/ArcInfo for editing
- Personal Geodatabase
  - MS Access format
  - Allows only vector data storage (depending on software version)
  - Does not require ArcSDE or ArcInfo licenses for editing
  - 2 GB Limit



Lecture: Vector Data Storage

Feature Class

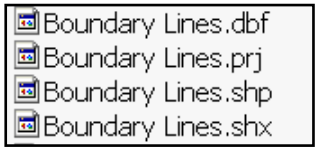
A collection of geographic features with the same geometry type (such as point, line, or polygon), the same attributes, and the same spatial reference. Feature classes can stand alone within a geodatabase or be contained within shapefiles, coverages, or other feature datasets. Feature classes allow homogeneous features to be grouped into a single unit for data storage purposes. For example, highways, primary roads, and secondary roads can be grouped into a line feature class named "roads".

Shapefile

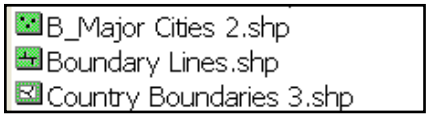
A vector data storage format for storing the location, shape, and attributes of geographic features. A shapefile is stored in a **set of related files and contains one feature class**.

Layer Files

In ArcGIS, a **reference to a data source**, such as a coverage, geodatabase feature class, raster, and so on, that defines how the data should be displayed on a map (**legends & labeling parameters**). Layers can also define additional properties, such as which features from the data source are included. Layers can be stored in map documents (.mxd) or saved individually as layer files (.lyr). Layers are conceptually similar to themes in ArcView 3.x.



In Windows Explorer, you can see all of the file types that make up the entire shapefile.



In ArcCatalog or ArcMap, shapefiles are displayed only as one file. Notice the various green icons to denote points, lines, polygons. Geodatabase feature classes are displayed the same way, except without the .shp extension.

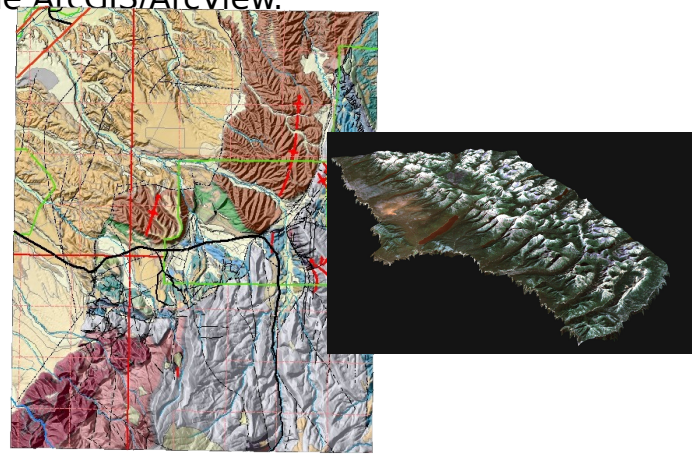
In ArcCatalog or ArcMap, layer files are displayed only as one file. Notice the various yellow diamond icons to denote points, lines, polygons. Remember, layer files only store a reference to the source data.

Exercise 1: Introduction to the ArcMap Interface

Background

ESRI's ArcGIS has been chosen by the US Army Corps of Engineers to be the standard software package for geospatial data analysis and viewing.

ArcGIS is ESRI's Premiere GIS software and provides a wide range of GIS tools for needs which range from Desktop mapping to Geostatistical Analysis. It is a scalable GIS system which includes ArcView, ArcEditor, and ArcInfo. For these curriculum we will use tools that are available in the ArcGIS/ArcView.



Goals

After this first exercise, the student will understand and be able to identify the features of the ArcMap interface, and distinguish the difference between the ArcGIS components.

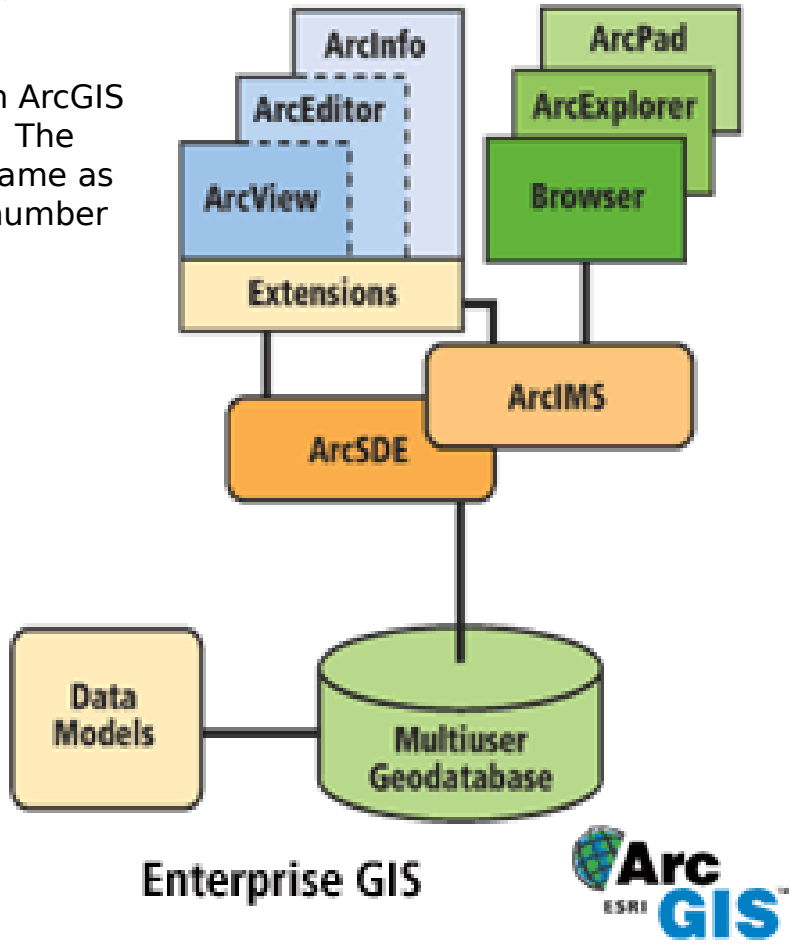
Objectives

1. The student will learn the different components of the ArcMap interfaces.
2. The student will be able to identify and name the tools and menus available in ArcMap

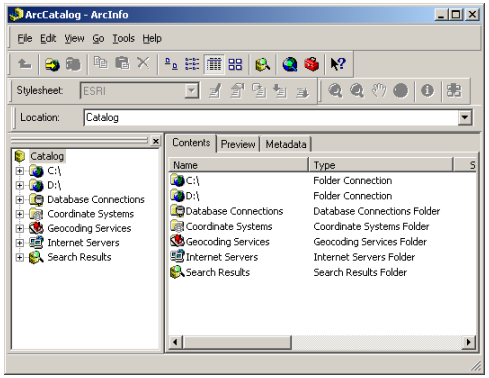
Exercise 1: Introduction to the ArcMap Interface

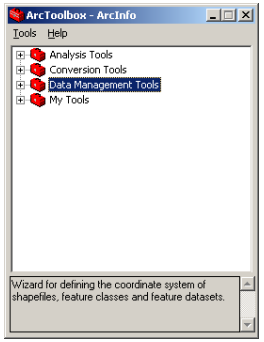
What Happened to ArcView and ArcInfo?

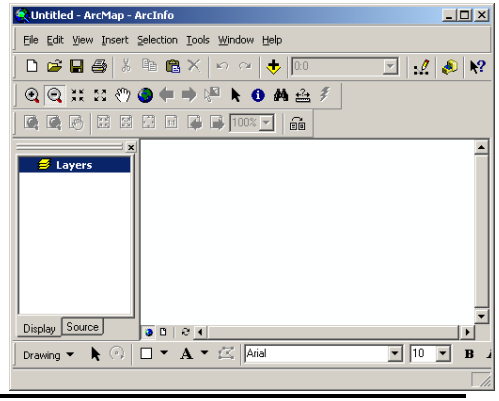
ArcView and ArcInfo are no longer separate applications. In ArcGIS they have been integrated into a single work environment. The interface that you use when working in ArcView looks the same as it does for ArcInfo. The difference between the two is the number of tools that are available in this interface.



Exercise 1: Introduction to the ArcMap Interface







ArcGIS has a three part interface:

- **ArcCatalog** – for navigating spatial data

  ArcCatalog is similar to the Windows "explorer", or the "My Computer" icon on your windows desktop. It is a tool for navigating through your GIS datasets. The benefit of using ArcCatalog is that it has been specially designed for use with spatial data.

  Using ArcCatalog you can easily preview both your spatial datasets, and the attribute data associated with them. ArcCatalog is provides an environment where it is safe to cut and paste spatial data into new directories, and even into the newest ESRI spatial data structure, the geodatabase. Additionally, several common conversion routines are available from ArcCatalog

- **ArcToolbox** – powerful geoprocessing tools

  For heavy duty processing, ArcToolbox contains analysis, conversion, and data management tools. Additionally, there is an option to construct your own custom tools. You may set up most tools using wizards which help take the guess work out of some of the otherwise complicated options.

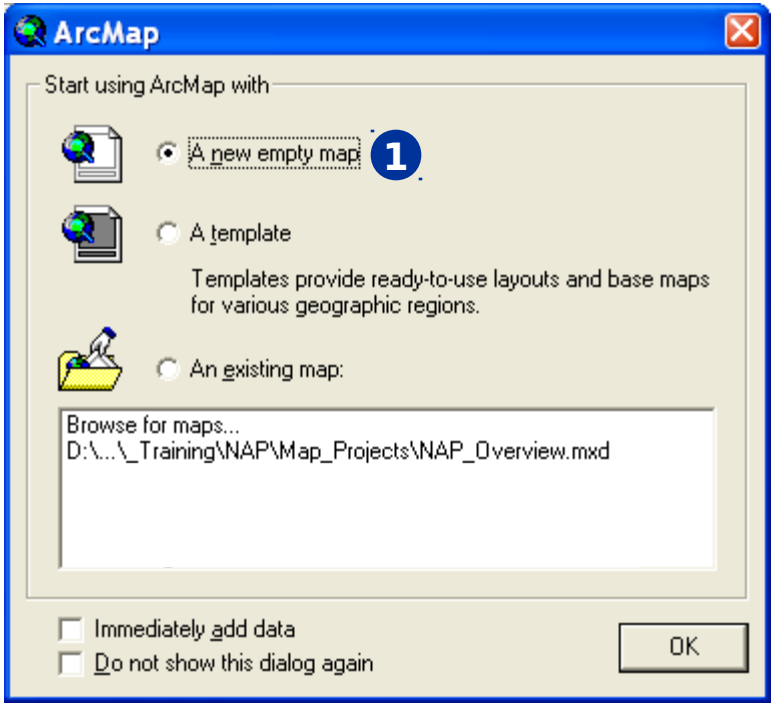
- **ArcMap** – for creating presentation graphics

  ArcMap is like a virtual drafting table. It contains a **canvas** where GIS data layers are drawn, and a **Table of Contents** (TOC) which helps keep track of the data in the canvas. For desktop mapping, this is the interface which you will spend most of your time in. Almost any interactive analysis and visualization takes place in ArcMap. The canvas can be viewed in two states, Data view is where most of the analysis is done. When you are ready to create a presentation, switch to layout view and you gain access to cartographic tools.

Exercise 1: Introduction to the ArcMap Interface

1. Open a new empty map in ArcMap
   - ☐ Open the ArcMap application.
   - ☐ Start → Programs → ArcGIS → ArcMap
   - ☐ Select the option to start ArcMap using "**a new empty map**".
   - ☐ Click **OK**.

2. Using the **page A-12** as a guide, identify the Title Bar, Menu Bar, Standard Toolbar, Table of Contents, Tools Toolbar, Status Bar, Draw Tools, and Display Area in your mapping display.



Exercise 1: Introduction to the ArcMap Interface

Title Bar

Menu Bar

Standard Toolbar

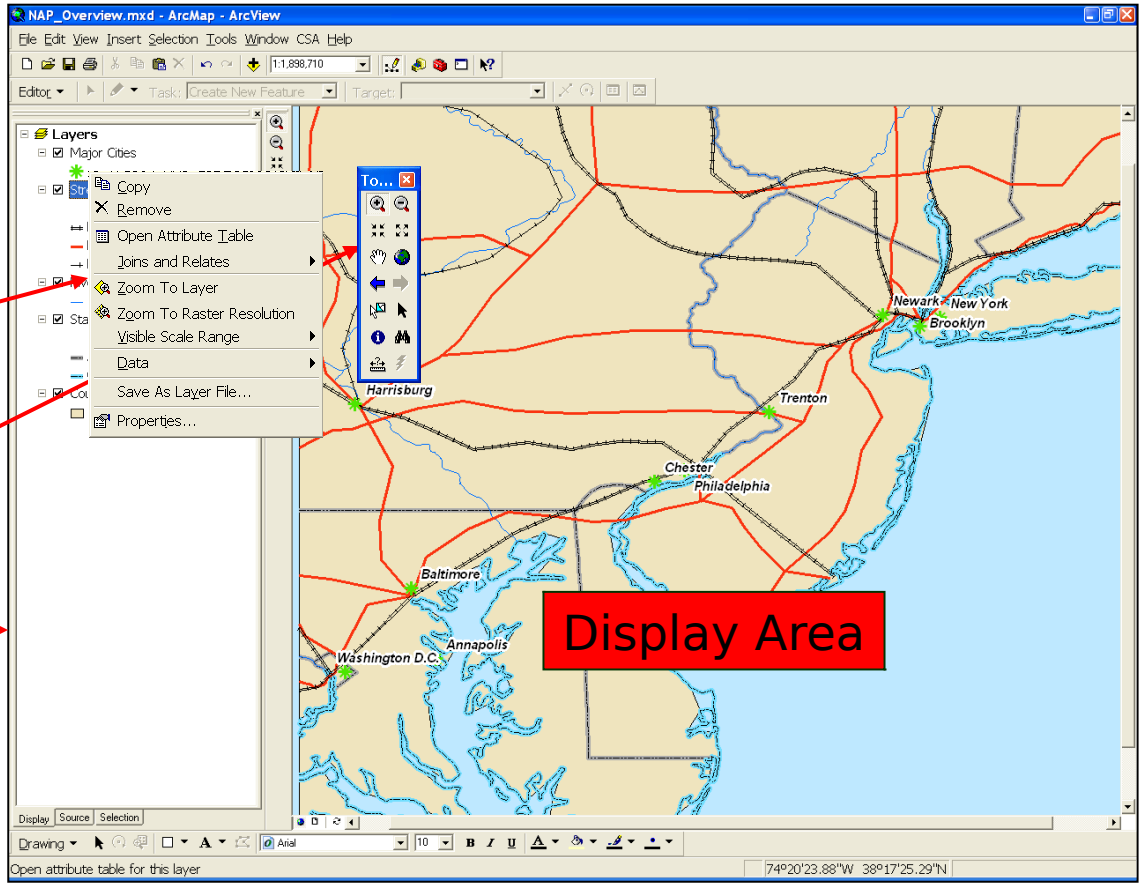
Context Menu

Tools Toolbar (dockable)

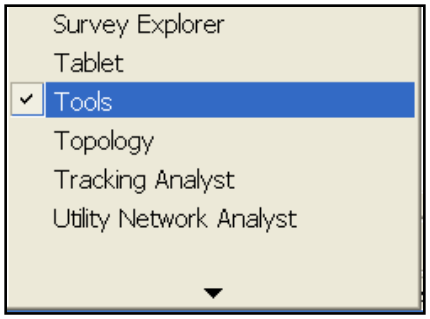
Table of Contents (dockable)

Draw Toolbar

Status Bar

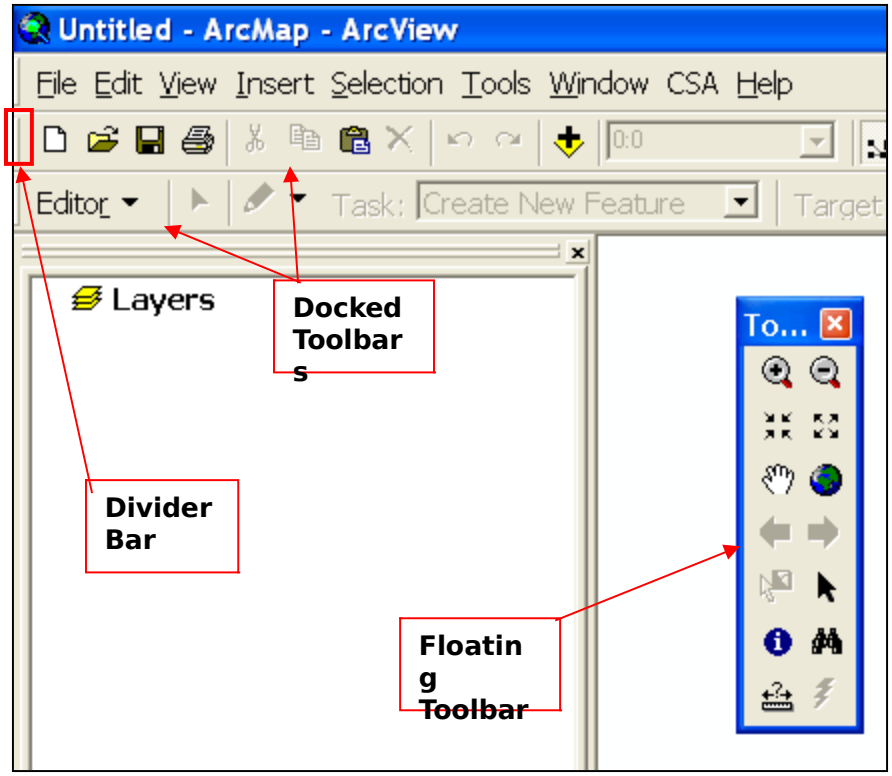


Exercise 1: Introduction to the ArcMap Interface



3. Toolbars, such as the **Tools**, **Standard**, and **Draw** can be toggled on and off. To **toggle any toolbar**,
   - ☐ Right-click on any toolbar. This will pop up a context menu of all of the available toolbars. To turn on a toolbar, simply click on the desired toolbar. To turn off a toolbar, locate the toolbar with a checkmark in front of the name. This denotes that the toolbar is turned on. To turn it off, click on the toolbar name.
   - ☐ For this lesson, first turn off the **Tools** toolbar. Notice the toolbar disappears from the ArcMap interface.
   - ☐ Next, toggle the Tools toolbar back on.

4. All menus and toolbars in ArcMap can be docked wherever the student desired. Toolbars can be moved be clicking on the **divider bar** at the beginning of the toolbar. While keeping the mouse button depressed, you can drag the toolbar to any location on the screen. Toolbars can remaining floating, or can be docked against an existing toolbar. To dock, drag the floating toolbar adjacent to a docked toolbar. An outline of the toolbar will appear, when this is visible, release the mouse button. This will dock the toolbar.
   - ☐ Dock and undock the **Tools** toolbar.



END OF EXERCISE 1

Exercise 2: Adding Data to the Mapping Display

Background

ArcMap and ArcCatalog use the same functions to connect to data sources. Using these functions, we are able to connect to the data sources and select our desired datasets to be added into our mapping environment. We will use ESRI's ArcGIS/ArcMap to overlap our various datasets.

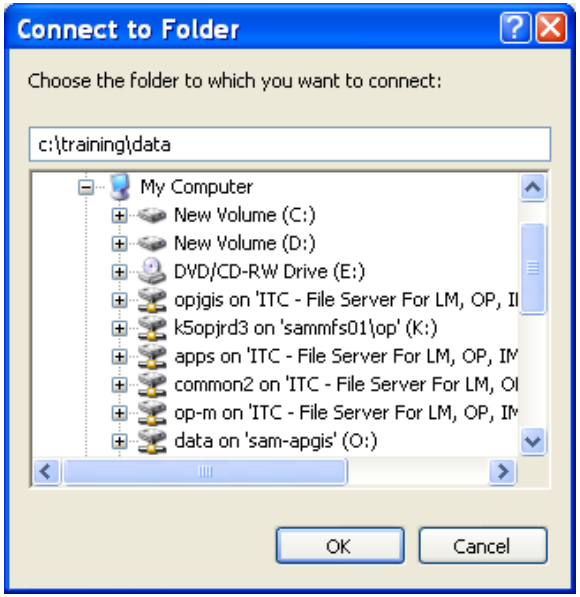
Goals

After this exercise, the will be able to locate sources of data and overlay them using tools available in ArcMap and ArcCatalog.

Objectives

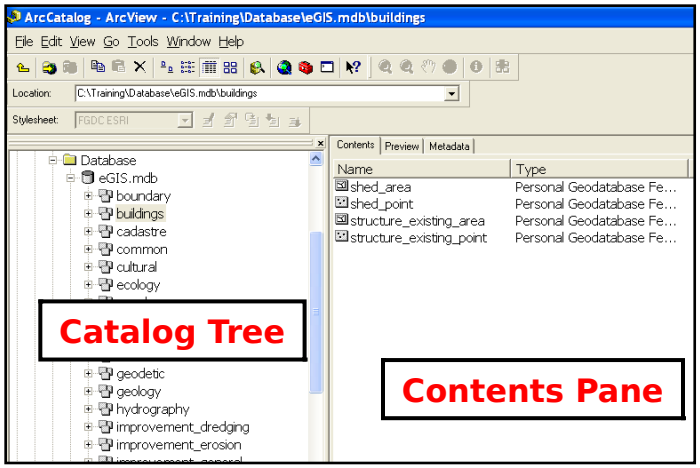
1. The student will learn how to connect to network and local data sources.
2. Using different techniques, the student will learn how to add in data using ArcCatalog and ArcMap into a mapping display.

Exercise 2: Adding Data to the Mapping Display


Connect to Folder
Choose the folder to which you want to connect:
c:\training\data
My Computer
New Volume (C:)
New Volume (D:)
DVD/CD-RW Drive (E:)
opjgis on 'ITC - File Server For LM, OP, II
k5opjrd3 on 'sammfs01\op' (K:)
apps on 'ITC - File Server For LM, OP, IM
common2 on 'ITC - File Server For LM, OI
op-m on 'ITC - File Server For LM, OP, IM
data on 'sam-apgis' (O:)
OK
Cancel

Adding a layer from ArcCatalog

1. Start ArcCatalog, Start → Programs → ArcGIS → ArcCatalog.
2. Make a connection to the NAP GIS Data Folder.
   - ☐ Click the Connect to Folder button .
   - ☐ Navigate to the folder or disk that you want to add to the Catalog.
     - ☐ Type in **C:\Training\Data**. Click OK.
3. Arrange the ArcCatalog and ArcMap windows so that you can see both on the screen.
4. In the Catalog Tree, navigate to the layer you want to add to the map.
   - ☐ Browse to **C:\Training\Data\Intro_to_ArcMap**
   - ☐ Using the + and – signs, expand or collapse directories.
5. Click and drag the layer from ArcCatalog.
   - ☐ Select a few layers (use the Shift key to select multiple layers) in the contents pane and drag them into ArcMap
6. Drop the layer over the map display in ArcMap.



Adding a layer from the Add Data button

1. Click the Add Data button .
2. Click the Look in dropdown arrow and navigate to the folder that contains the shapefiles.
3. Click the layer and click Add.

Exercise 2: Adding Data to the Mapping Display

- ☐ If you have not done so already, browse to **C:\Training\Data\Intro_to_ArcMap** and using the Add Data tool, add in **ALL** the data from this directory into your mapping display.

About data frames

- ☐ A data frame is the most fundamental element in a map document and in the ArcMap user interface. When you create a map, it contains a default data frame listed in the table of contents as Layers.
- ☐ The properties of a data frame define the context for the data with which you work; these include the coordinate system, measurement units, scale, the drawing order of layers, and so on. In ArcMap, there is a view called data view that isolates the contents of a data frame for you to edit or work with.
- ☐ Data frames and the table of contents are the primary ways to interact with geographic data in ArcMap. Data frames can be set to show data at all scales and extents, a specific scale, or a specific extent, depending on what you need your map to do. You can navigate or change the extent of a data frame to view data for specific locations using the pan and zoom tools in ArcMap.

Exercise 2: Adding Data to the Mapping Display

Adding a data frame

1. Click the Insert menu.
2. Click Data Frame. The new data frame will appear in the center of the layout.
3. Using the Add Data tool, add the **oa19992000_landsat.jpg** image from **C:\Training\Data\Intro_to_ArcMap** .

Making a data frame active

4. Right-click the data frame in the table of contents.
5. Click Activate.
   - ☐ Activate the **Layers** data frame. Notice how the data display changes.

Removing a data frame

6. Right-click the data frame you want to remove in the table of contents.
   - ☐ Right-click on the **New Data Frame**.
7. Click Remove.

Exercise 2: Adding Data to the Mapping Display

The table of contents

1. The table of contents lists all the layers on the map and shows what the features in each layer represent. The check box next to each layer indicates whether or not the layer is currently drawn on the map. By default, the table of contents is located on the left side of the ArcMap window.
2. The order of layers within the table of contents is also important; the layers at the top draw on top of those below them. Thus, you'll put the layers that form the background of your map, such as the ocean, at the bottom of the table of contents.
3. To change the drawing order in the Table of Contents:
   - ☐ On the **Display tab**, click and drag the layer up or down in the table of contents.
   - ☐ A black line indicates where the layer will be placed.
   - ☐ Release the mouse pointer to drop the layer in its new position.

   The order of layers listed in the table of contents determines how layers are drawn on a map. Within a data frame, the layers listed at the top will draw over those listed below them, and so on down the list. You can easily move layers around to adjust their drawing order or organize them in separate data frames.

Exercise 2: Adding Data to the Mapping Display

About looking at a map in data view and layout view

ArcMap provides two ways to view a map:

- Data view
- Layout view

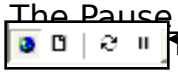
Each view lets you look at and interact with the map in a specific way.

When you want to browse the geographic data on your map, choose data view. Data view is an all-purpose view for exploring, displaying, and querying the data on your map. This view hides all the map elements on the layout, such as titles, North arrows, and scale bars, and lets you focus on the data in a single data frame, for instance, editing or analysis.

When you're preparing your map to hang on the wall, put in a report, or publish on the Web, you'll want to work with it in layout view. In layout view, you'll see a virtual page upon which you can place and arrange map elements, and you can do almost everything you can in data view, plus design your map.

Pausing drawing in ArcMap

The Pause Drawing button allows you to temporarily suspend all drawing in ArcMap so you can make changes to your map, such as changing the symbology of several layers, without having the map redraw after each change. Once you have made your changes, you can click this button again to turn on drawing. The Pause Drawing command works in data view or layout view.



These tools are located in the lower left hand corner of the mapping display.

Exercise 2: Adding Data to the Mapping Display

How to look at a map in data view and layout view

Switching to data view

1. Click the View menu.
2. Click Data View. The ArcMap window displays the active data frame.

Tip

- You can also switch to data view by using the Data View button on the lower left of the view window.

Switching to layout view

3. Click the View menu.
4. Click Layout View. The ArcMap window displays the entire map.

Tip

- You can also switch to layout view by using the Layout View button on the lower left of the view window.

Pausing drawing in ArcMap

5. Click the Pause Drawing button whenever you want to suspend drawing. The Pause Drawing button is located in the lower left of the view window, next to the Refresh button.
6. You can also press F9 as a shortcut to pausing drawing.
7. Click the button again when you want to resume drawing.

Exercise 2: Adding Data to the Mapping Display

I added data to my data frame, but the layers do not line up. Why?

- In most cases the problem will be that the data that you are attempting to overlay may be in different projections. When working with spatial data, it is important to know the projection of your data. By establishing a baseline projection, this will ensure the data will overlay properly.
- Projection—A mathematical formula that transforms feature locations from the earth's curved surface to a map's flat surface. Projections can cause distortions in distance, area, shape, and direction; all projections have some distortion. Therefore, the projection type is often placed on the map to help readers determine the accuracy of the measurement information they get from the map.

Exercise 3: Using the View Navigation Tools

Background

As you work with a map, you can easily change how you view the data it contains. When you're just browsing a map, you might want to pan and zoom around the data to investigate different areas and features. Most of the tools for navigating your data are found on the Tools toolbar.

When you don't want to adjust your map display, yet you want to see more detail or get an overview of an area, open another window. ArcMap provides two additional ways to explore the spatial data on your map: through a magnifier window and an overview window.

Goals

ArcMap contains a number of tools that allow the student to change the view of the mapping display. After this exercise the student will understand and be ability to utilize the viewing tools available in ArcMap.

Objectives

1. The student will learn the functions of the view navigation tools on the Tools toolbar.
2. The student will learn how to use the Overview and Magnifier window.

Exercise 3: Using the View Navigation Tools

About moving around a map

- ☐ As you work with a map, you can easily change how you view the data it contains. When you're just browsing a map, you might want to pan and zoom around the data to investigate different areas and features. Most of the tools for navigating your data are found on the **Tools toolbar**.
- ☐ The Pan and Zoom tools on the ~~**Layout toolbar**~~ are used to pan or zoom your layout and are only available when you're

Zooming in or out

1. Click the Zoom In button or Zoom Out button on the Tools toolbar.
2. Move the mouse pointer over the map display and click once to zoom around a point. Alternatively, click and drag a rectangle defining the area on which you want to zoom in or out.
   - ☐ Zoom into Cape May, NJ.
   - ☐ Click the Zoom to Previous button, , to return to the extent of the project data.

Panning

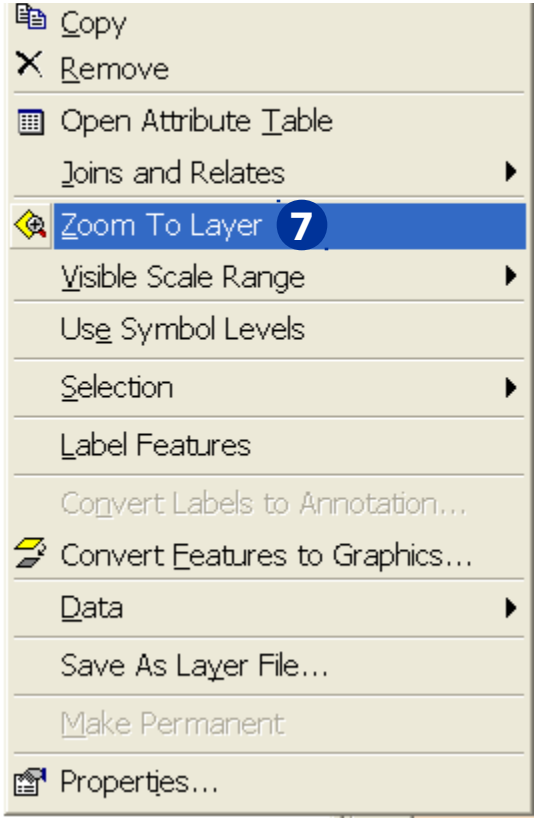
3. Click the Pan button on the Tools toolbar.
4. Move the mouse pointer over the map display and click and drag the pointer.
   - ☐ Pan to the north part of the island.

Exercise 3: Using the View Navigation Tools

5. Click the Full Extent butt on the Tools toolbar to return to the full extent of the project area.

Tips

- If your layer doesn't draw when you zoom in or out, it probably has a Visible Scale Range set that prevents it from displaying on the map at certain scales. You can clear the scale range by right-clicking the layer in the table of contents and clicking Visible Scale Range.
- If your map has more than one data frame, panning and zooming will occur in the active data frame. In layout view, clicking a data frame will activate it.
- If the Full Extent button on the Tools toolbar is disabled, the data frame may be set to a fixed extent or fixed scale. To enable the Full Extent button, click the View menu, click Data Frame Properties, click the Data Frame tab, and click Automatic extent.



Zooming to the extent of a layer

6. Right-click the layer or layers to which you want to zoom.
   - ☐ Zoom to the extent of the **flood_zone_area_CCH** data layer.
7. Click **Zoom To Layer**.

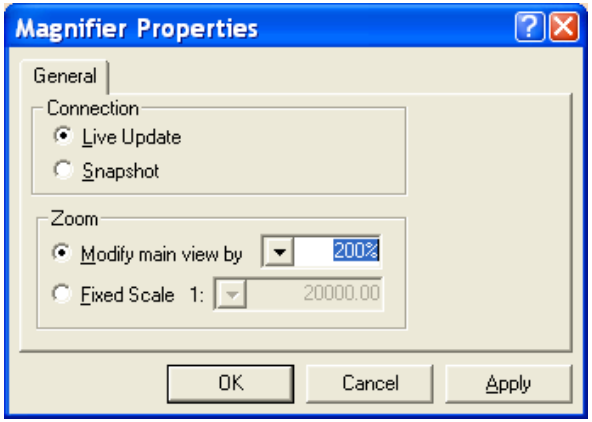
Exercise 3: Using the View Navigation Tools

About magnifier and overview windows

- ☐ When you don't want to adjust your map display, yet you want to see more detail or get an overview of an area, open another window. ArcMap provides two additional ways to explore the spatial data on your map: through a magnifier window and an overview window.
- ☐ The magnifier window works like a magnifying glass; as you pass the window over the data, you see a magnified view of the location under the window. Moving the window does not affect the current map display.

Opening a magnifier window and setting the view

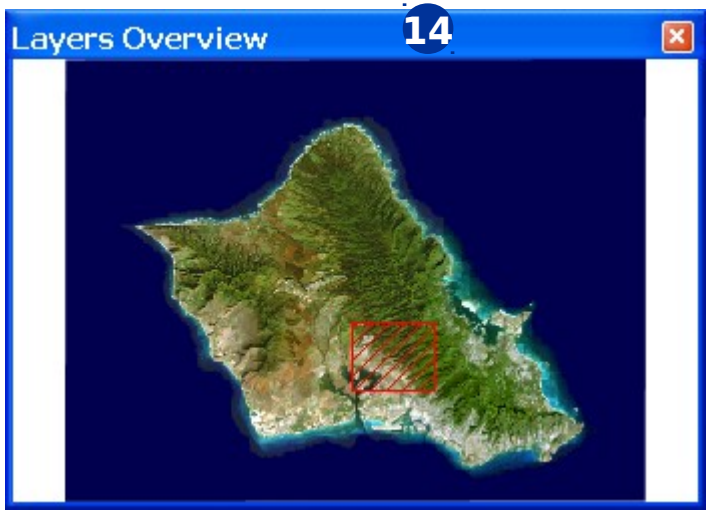
8. Click the **Window menu** and click **Magnifier**. You must be viewing the map in data view to display a magnifier window.
9. Drag the magnifier window over the data.
   - ☐ Move the magnifier window over the **Honolulu area**.
10. Right-click the title bar and click Snapshot to lock the view.
    - ☐ When the window is in Snapshot mode, the window can be moved around the mapping display without updating the magnifier window.
    - ☐ Right-click on the title bar and click Snapshot to unlock the view.
12. To adjust the properties of the magnifier, right-click on the title bar and select Properties. The default zoom scale for the magnifier window can be modified.



Tips

- ☐ Right-click the title bar and click Properties to set the window's options.
- ☐ When you are in snapshot mode, you can use any of the ArcMap interactive tools to work with the contents of the window. To zoom to the full extent while you are in snapshot mode, right-click the title bar and click Full Extent.

Exercise 3: Using the View Navigation Tools

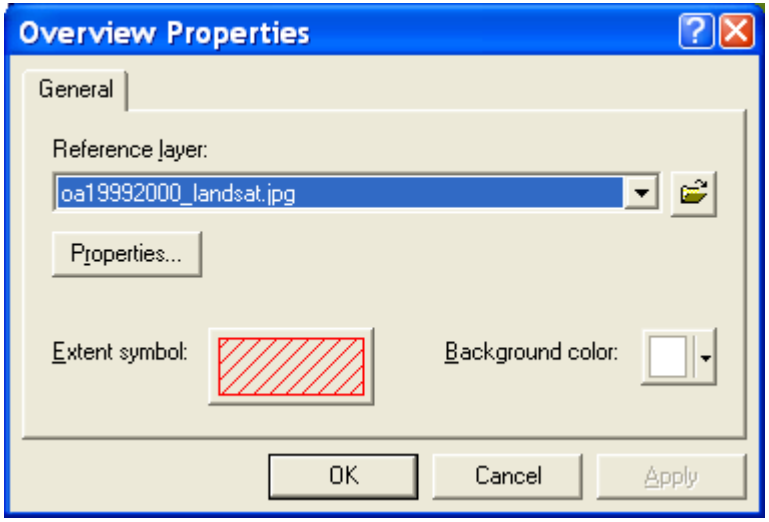


Opening an overview window to pan and zoom the map

13. Click the **Window menu** and click **Overview**. You must be viewing the map in data view to display an overview window.
14. Right-click on the Overview title bar and select **oa19992000_landsat.jpg** as the reference layer.
15. Click OK.
16. Zoom into an area of the image and notice how the Overview extent symbol changes.

Tips

- ☐ Right-click the title bar and click Properties to set the window's options.
- ☐ You can use transparent symbols or layers with uncomplicated symbology when working with overview windows.



Exercise 4: Using the Tools Toolbar

Background

ArcMap is a dynamic environment that lets you explore and query map data and get the information you need. You can explore data in various ways. For example, you can:

- Point to features to find out what they are.
- Examine all the attributes of a particular layer.
- Find features that have a particular characteristic or attribute.
- Measure distances on the map.

Goals

One of the main differences between CAD and GIS is the ability to view attribute information. In this exercise the student will learn how to view feature attribute details and access and utilize the measure tool.

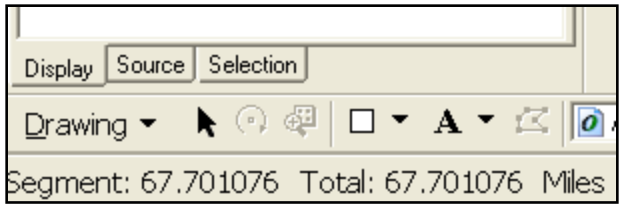
Objectives

1. The student will gain an understanding of the remaining tools on the Tools toolbar.
2. The student will be able to view attribute information of feature layers.
3. The student will learn how to measure distances on a map in various units.

Exercise 4: Using the Tools Toolbar

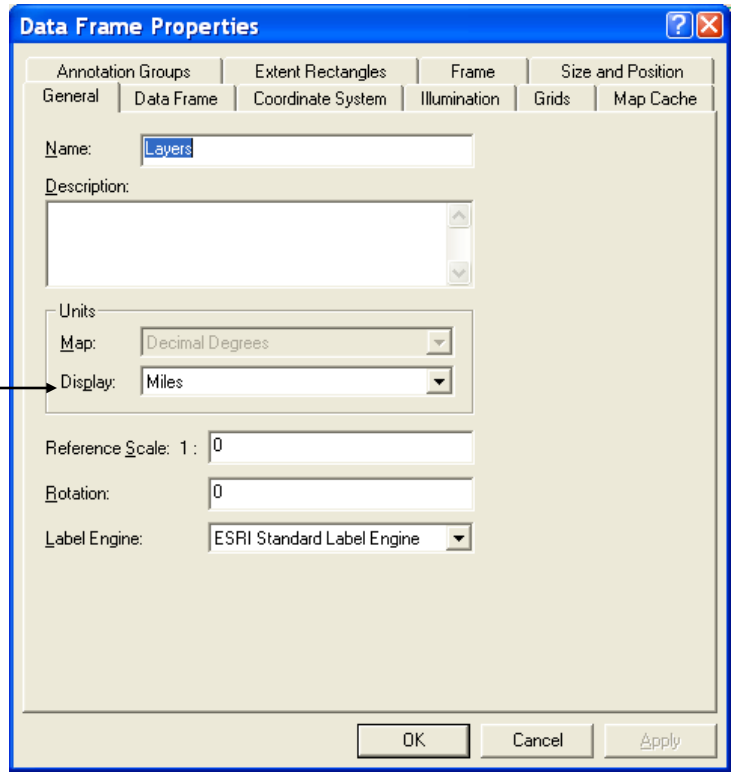
Measuring distance

1. Click the Measure butt[icon] on the Tools toolbar.
2. Use the mouse pointer to draw a line representing the distance you want to measure. The line can have more than one line segment.
   - ☐ Measure the distance of the width of Oahu.
3. Double-click to end the line. Results will be displayed in the Status bar.

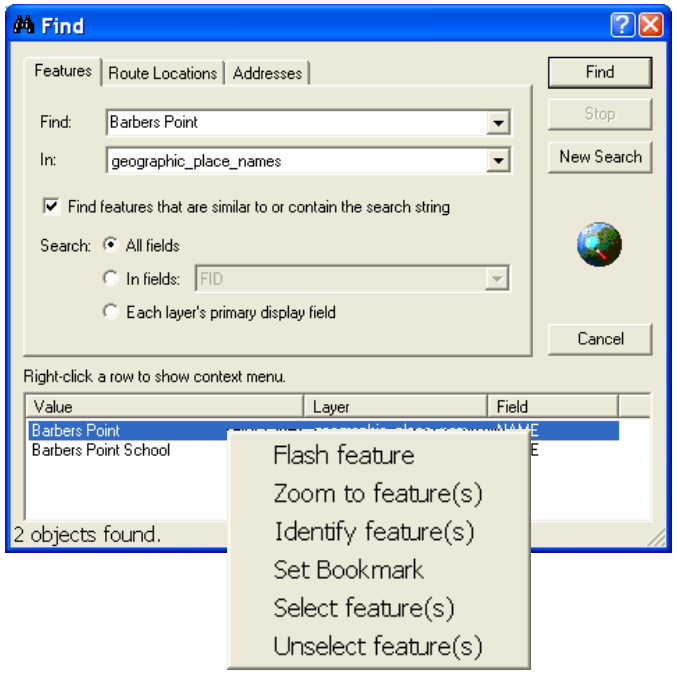


Tip:

- ☐ To change the units of the measurement, right-clicking on the mapping display and select Properties. From the **General** tab, change the **Display units**.



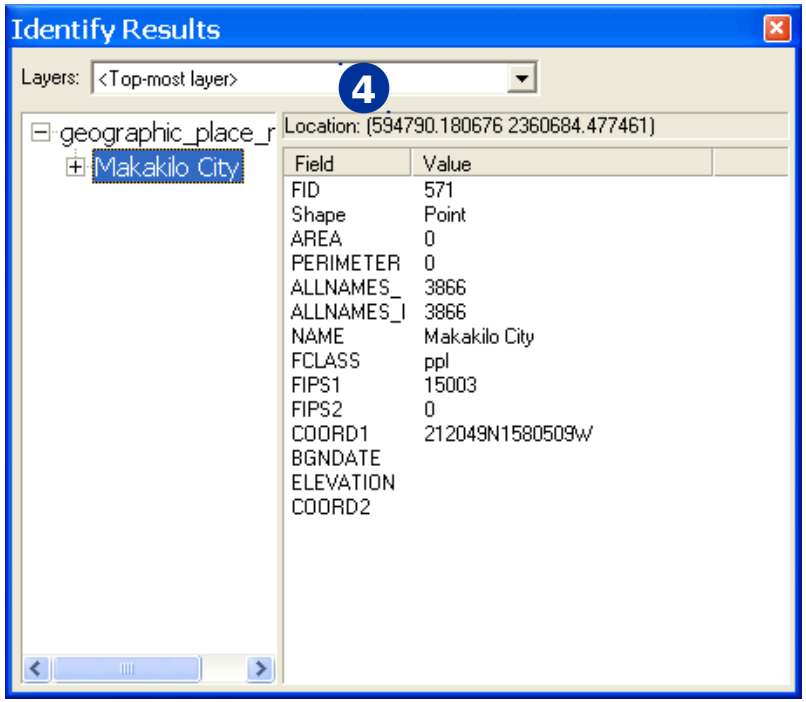
Exercise 4: Using the Tools Toolbar



Finding features with particular attributes

1. Click the Find button on the Tools toolbar.
2. Click the Features tab.
3. Type the string you want to find in the Find text box.
   - ☐ Type '**Barbers Point**'
4. Click the In layers dropdown arrow and click the layer you want to search.
   - ☐ Select the layer, **geographic_place_names**
   - ☐ Uncheck Find features that are similar to or contain the search string if the string must match exactly.
5. Search for the string in all fields, in a specific field, or in the primary display field.
6. Click Find.
7. You can interact with the search results, simply by right-clicking on the records.
   - ☐ Right-click on **Barbers Point** and select **Zoom to feature(s)** option. Notice how the mapping display is automatically zoomed to the location.
   - ☐ Right-click on **Barbers Point School** and select Set Bookmark
   - ☐ Bookmarks retain the bounding coordinates of a predefined selection. To go to a Bookmark, from the **View menu, select Bookmarks → Barbers Point School**. This will automatically zoom you to the location on the map.

Exercise 4: Using the Tools Toolbar



Identifying features by pointing to them

1. Click the Identify butt on the Tools toolbar.
2. Click the mouse pointer over the map feature you want to identify.
   - ☐ Click a point on the mapping display that represents a **geographic place name**.
3. The Identify Results dialog box opens.
4. The features in the **uppermost layer** under the pointer will be identified. To identify a different layer, select the desired layer from the Layers selection box.

Tips

- ☐ You can hold down the Shift key while clicking the map to keep the results of your previous clicks in the Identify Results dialog box.

Exercise 5: Using the Selection Tools

Background

Often, just looking at a map isn't enough; you must also query it according to feature locations and attributes to solve problems. You can discover new spatial relationships when you start asking questions such as:

- Where is...?
- Where's the closest?
- What's inside?
- What intersects?

ArcMap provides a number of tools to help you find answers to these types of questions.

With ArcMap, you can:

- Find out what a feature is by pointing to it. This may display additional information such as a picture or Web page.
- Find features with particular attributes such as cities with a population greater than one million.
- Find features with a particular spatial relationship. For instance, you can find the wildlife habitats within 50 kilometers of an oil spill or find all traffic accidents that occurred along a particular stretch of road.

Goals

Using a variety of selection tools, the student will learn which Selection tool works best for identifying features that answer their data analysis questions.

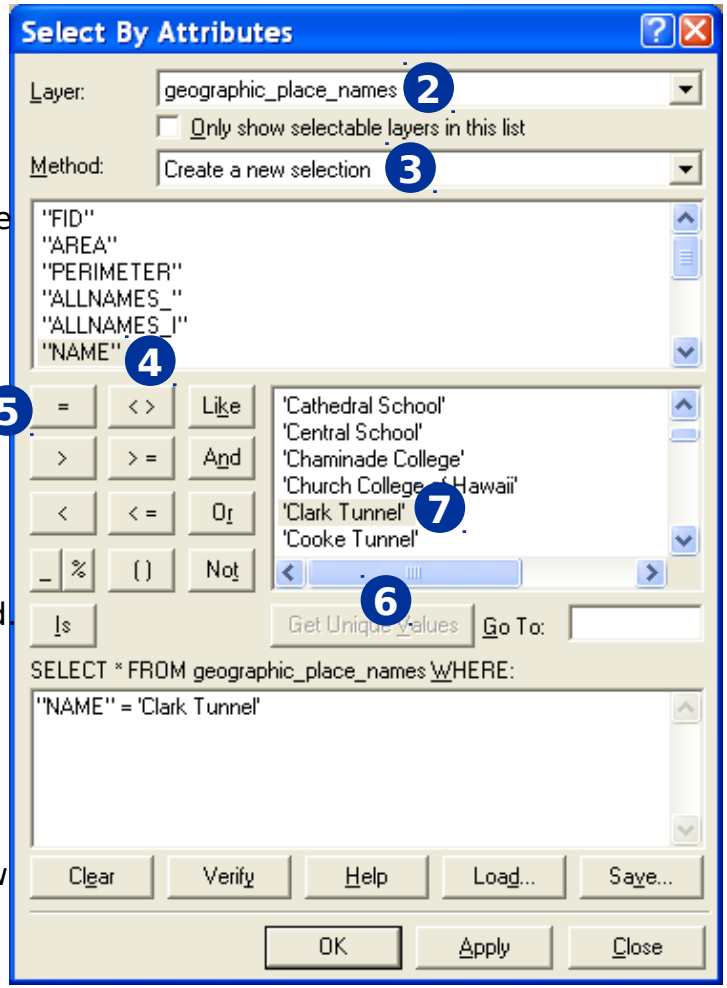
Objectives

1. The student will learn how to use the following tools:
   - Select by Attribute
   - Select by Graphic(s)
   - Select by Location
2. The student will learn the different interactive selection methods.
3. This student will learn how to use the Select Features tool.

Exercise 5: Using the Selection Tools

How to use Select by Attributes

1. Click Selection on the Main menu and click **Select By Attributes**.
2. Click the Layer dropdown arrow and click the layer containing the features you want to select.
   - ☐ Select **geographic_place_names**
3. Click the Method dropdown arrow and click a selection method.
   - ☐ Select **Create a new selection**
4. Double-click a field to add the field name to the expression box.
   - ☐ Double-click on **NAME**
5. Click an operator to add it to the expression.
   - ☐ Click on the = sign
6. Click **Get Unique Values** to see the values for the selected field.
7. Double-click a value to add it to the expression.
   - ☐ Double-click on **'Clark Tunnel'**
8. Click the Verify button to see if you are using proper syntax or if the criteria you've entered will select any features .
9. Click **Apply**.
10. The status bar at the bottom of the ArcMap window tells you how many features are selected.
11. Click Close when you are finished selecting features.
12. To zoom to the feature, from the **Selection** menu, select **Zoom to Selected Features**.

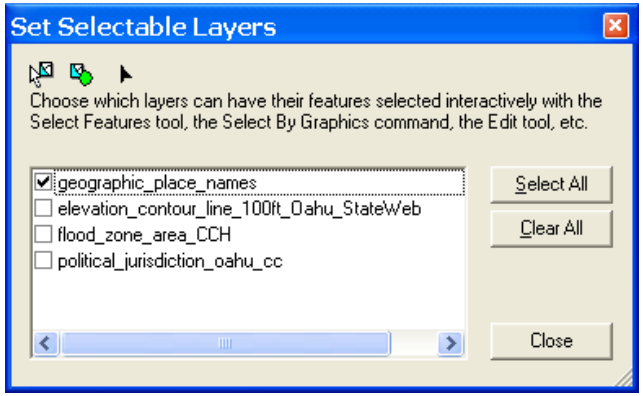


Exercise 5: Using the Selection Tools

1. You can select features with your mouse pointer by clicking them one at a time or by **dragging a box** around them.
2. Before you select features with one of these methods, you can specify the layers you want to select from the selectable layers. Do this when the features you want to select overlap or are close to features from other layers.

   For example, if you have a layer of cities where many of the cities are on rivers, you can avoid selecting rivers by specifying that you want to select from the cities layer only. You can select from the layers that are checked in the Selection tab at the bottom of the table of contents or in the **Set Selectable Layers** dialog box.

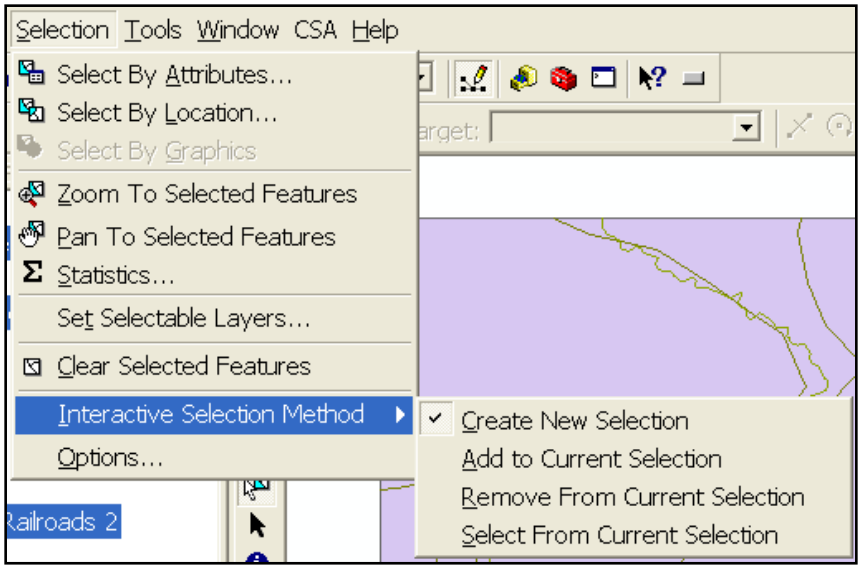
   - ☐ Turn on all layers in your table of contents. Use the **Select Featu** tool, , to drag a selection box around the Honolulu area. Notice how many features from multiple layers have been selected.
   - ☐ From the **Selection** menu, select **Clear Selected Features**.
   - ☐ For this lesson, from the **Selection** menu and select **Set Selectable Layers**. Uncheck the layers you don't want to be able to select from.
   - ☐ Uncheck all of the layers except **geographic_place_names**.
   - ☐ Now, when we use the **Select Features** tool, , only features in the geographic_place_names will be selected.



Exercise 5: Using the Selection Tools

Selecting features by clicking them in the map

1. Click the Selection tab at the bottom of the table of contents, or click the Selection menu and click Set Selectable **Layers**.
2. Check the boxes next to the layers from which you want to select, and uncheck the boxes you don't want to select.
3. Click **Selection** on the Main menu, point to **Interactive Selection Method**, then click **Create New Selection**.
4. Click the Select Features button , from the Tools toolbar.
5. Click the feature you want to select.
   - ☐ Select the points in southeastern Oahu.
6. Hold down the **Shift key** while clicking features to select additional features.
   - ☐ Also select the points for northwestern Oahu.
7. To remove a feature from the selected set, click the **Selection** menu, point to **Interactive Selection Method**, and click **Remove From Current Selection**. Click a selected feature and it deselects.
   - ☐ Select the group of points in southeastern Oahu. This will remove it from the current selection.
   - ☐ Set the Interactive Selection Method back to **Create New Selection**.



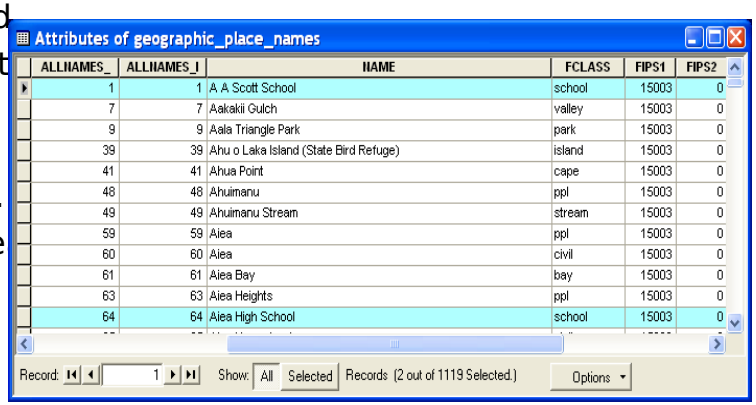
Exercise 5: Using the Selection Tools

Selecting features by dragging a box around them

1. Click the Select Features button, from the Tools toolbar.
2. Click and **drag a box** around the features you want to select.
3. Hold down the Shift key as you drag the box to select additional features.
4. To remove a feature from the selected set, click the Selection menu, point to Interactive Selection Method, and click Remove From Current Selection. Drag a box around the features you want to deselect.

Selecting features by clicking them in a table

1. Right-click a layer in the table of contents and click **Open Attribute Table**.
   - ☐ Open the attribute table for **geographic_place_names**
2. Select a feature in the table by clicking to the left of a record.
3. Hold down the Ctrl key and click additional features to select
   - ☐ Select the some records where the **FCLASS** attribute equals **school**.
   - ☐ You may have to scroll to the right to see this attribute.
4. To deselect a feature, hold down the Ctrl key and click the fe
   - ☐ Close the attribute table.


Attributes of geographic_place_names
ALLNAMES_
ALLNAMES_I
NAME
FCLASS
FIPS1
FIPS2
1 1 A A Scott School school 15003 0
7 7 Aakakii Gulch valley 15003 0
9 9 Aala Triangle Park park 15003 0
39 39 Ahu o Laka Island (State Bird Refuge) island 15003 0
41 41 Ahua Point cape 15003 0
48 48 Ahuimanu ppl 15003 0
49 49 Ahuimanu Stream stream 15003 0
59 59 Aiea ppl 15003 0
60 60 Aiea civil 15003 0
61 61 Aiea Bay bay 15003 0
63 63 Aiea Heights ppl 15003 0
64 64 Aiea High School school 15003 0
Record: 1
Show: All Selected
Records (2 out of 1119 Selected.)
Options

Exercise 5: Using the Selection Tools

Zooming to Selected Features

1. From the Selection menu, chose Zoom to Selected Features.
2. This will zoom to the extents of the selected features in the map display.

How to select features with a graphic

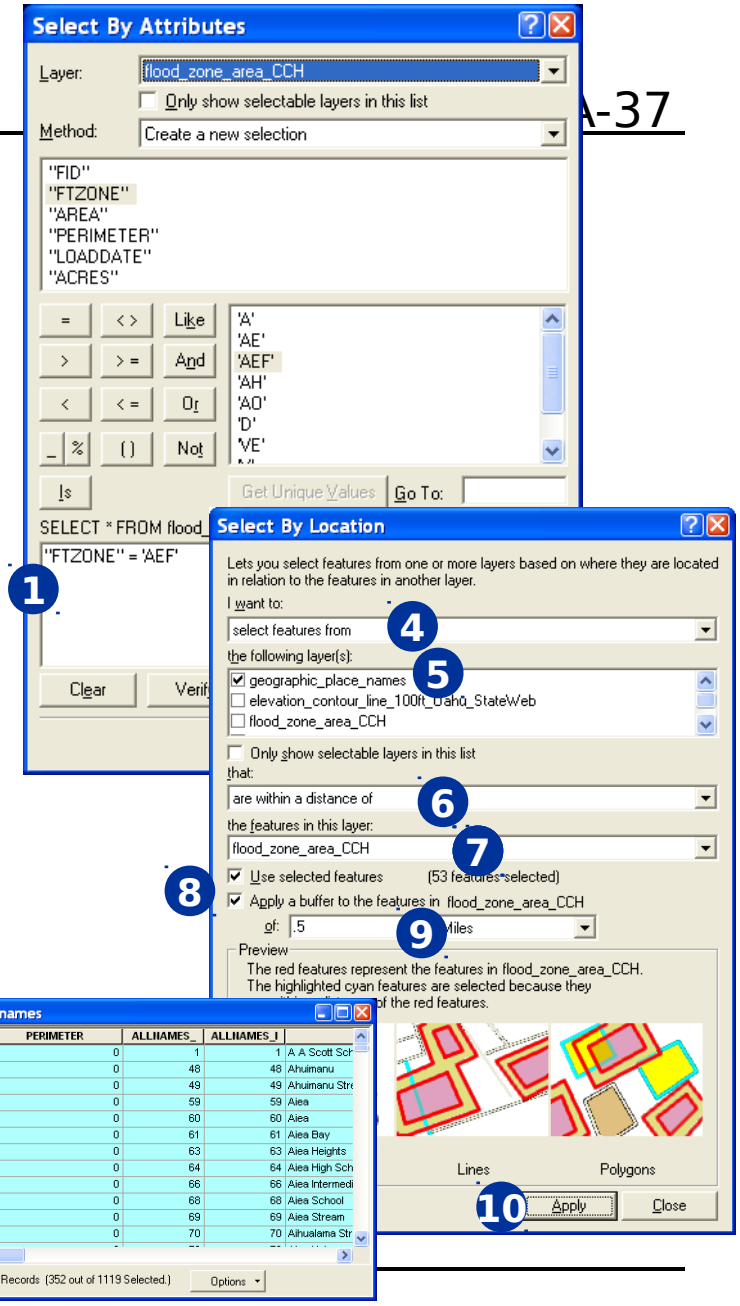
1. Zoom to the extents of the mapping display with the Zoom Exten[image] utton, [image].
2. Click the New Graphic tool dropdown arrow and click a new graphic tool, such as the New Po[image]on tool,
   - ☐ Use the New Polygon graphic tool that is located on the Drawing toolbar. The Drawing toolbar is

   The access the draw polygon tool, click the sub menu arrow.
3. Click to draw a new graphic in the view.
   - ☐ Draw a graphic around the points in the southwestern Oahu. Click to add vertices of the polygon and double-click to close the polygon.
4. Click **Selection** on the Main menu and click **Select by Graphics**.
5. The features contained by or intersecting the graphic will be highlighted to show they are selected.
   - ☐ Delete the graphic in the mapping display by using your delete key on the keyboard.

Exercise 5: Using the Selection Tools

How to Select by Location

1. Using the steps learn on page A-32, select all attributes for **flood_zone_area_CCH** where **FTZONE = 'AEF'** (see syntax to the right).
2. Our next step will be to locate all features geographic_place_names that are within .5 miles of this flood zone.
3. Click Selection on the Main menu and click **Select By Location**.
4. Choose '**select features from**'
5. The following layer(s): **geographic_place_names**
6. That: **are within a distance of**
7. The features in this layer: **flood_zone_area_CCH**
8. Check **Use Selected Features** and Check **Apply a buffer to the features...**
9. Enter **.5** and select **Miles** as the unit.
10. Click Apply and Close the window.
11. Open the attribute table for geographic_pl
12. View all Selected Records. All of these loc
    5 miles of the FTZONE='AEF'.



STOP **END OF EXERCISE 5**

Exercise 6: Symbolizing Layers

Background

Often, seeing where something is—and where it isn't—can tell you exactly what you need to know. Mapping the location of features reveals patterns and trends that can help you make better decisions. For example, a business owner might map where his customers live to help decide where to target his advertising.

The easiest way to see where features are is to draw them using a single symbol. You can draw any type of data this way. When you create a new layer, ArcMap draws it by default with a single symbol.

Categories can also be used when symbolizing data. A category describes a set of features with the same attribute value. For example, given parcel data with an attribute describing land use, such as residential, commercial, and public areas, you can use a different symbol to represent each land use. Drawing features this way allows you to map features and to which category they belong. This can be useful if you're targeting a specific type of feature for an action or policy. For instance, a city planner might use the land use map to target areas for redevelopment.

Goals

After this exercise the student will understand the process involved in symbolizing vector features on a map.

Objectives

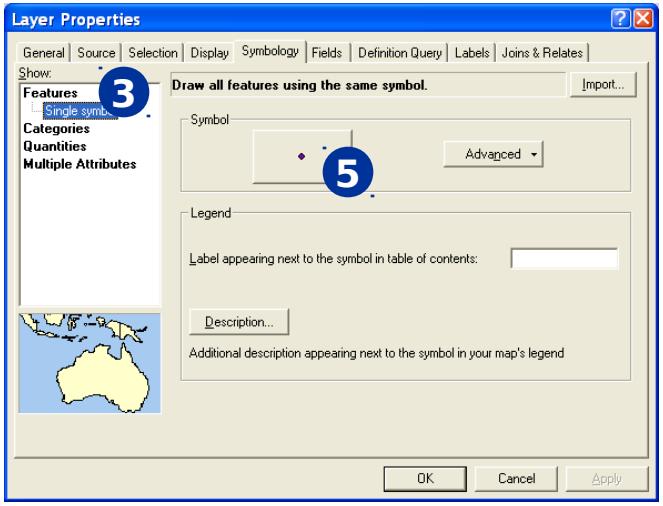
1. Using the feature properties, the student will learn how to symbolize single features.
2. Using the categories option, the student will learn how to apply a customized legend to a feature layer.

Exercise 6: Symbolizing Layers

About using a single symbol to draw features

- ☐ Often, seeing where something is—and where it isn't—can tell you exactly what you need to know. Mapping the location of features reveals patterns and trends that can help you make better decisions. For example, a business owner might map where his customers live to help decide where to target his advertising.

- ☐ The easiest way to see where features are is to draw them using a single symbol. You can draw any type of data this way. When you create a new layer, ArcMap draws it by default with a single symbol.

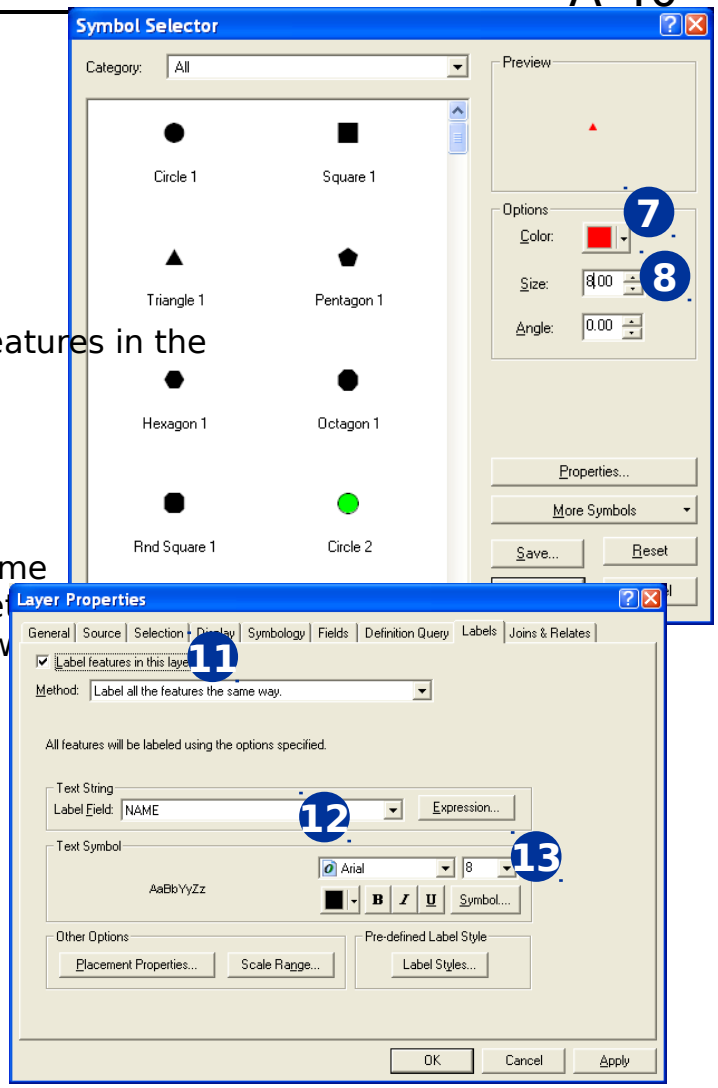


How to draw a layer using a single symbol

1. Right-click the layer you want to draw with a single symbol in the table of contents and click Properties.
   - ☐ Right-click on that **geographic_place_names** layer.
2. Click the Symbology tab.
3. Click Features.
4. Because Single Symbol is the only option, ArcMap automatically selects it.
5. Click the Symbol button to change the symbol.
6. Click a new symbol or change specific properties of the symbol in the Symbol Selector dialog box.
   - ☐ Find the Triangle 1 symbol. Select this symbol.

Exercise 6: Symbolizing Layers

7. Change the color to Red.
8. Change the Size to 12.
9. Click OK.
10. Click on the Labels tab,
11. Check the Label feature in this layer box. This will label all features in the layer.
12. Select **NAME** as the label field.
13. Adjust the Font, Font Style, and Font Size.
14. Click OK.
15. To toggle the labels for the layers, right-click on the layer name and select Label Features. Since the label properties were set above, each time the labels are toggled they will be viewed with the same symbology.



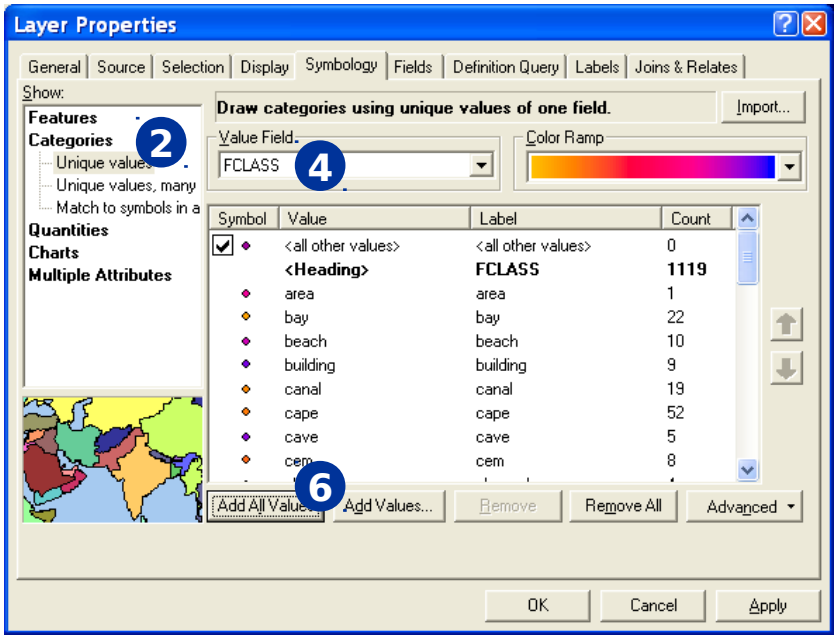
Exercise 6: Symbolizing Layers

About categorizing features

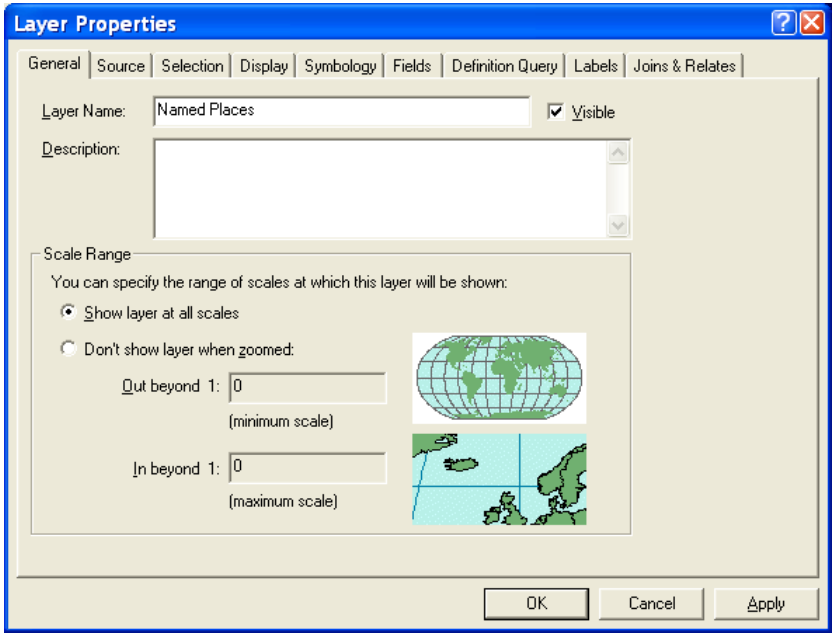
A category describes a set of features with the same attribute value. For example, given parcel data with an attribute describing land use, such as residential, commercial, and public areas, you can use a different symbol to represent each land use. Drawing features this way allows you to map features and to which category they belong. This can be useful if you're targeting a specific type of feature for an action or policy. For instance, a city planner might use the land use map to target areas for redevelopment.

Drawing a layer showing unique values

1. Right-click the layer you want to draw showing unique values in the table of contents and click Properties.
   - ☐ Right-click on the **geographic_place_names** layer.
2. Click the Symbology tab and click **Categories**.
3. ArcMap automatically selects the Unique values option.
4. Click the Value Field dropdown arrow and click the field that contains the values you want to map.
   - ☐ Select **FCLASS** as the value field.
5. Click the Color Scheme dropdown arrow and click a color scheme.
6. Click **Add All Values**.
7. This adds all unique values to the list. Alternatively, click the Add Values button to choose which unique values to display.
8. Click a label in the Label column and type the label you want if you want to edit the default label so more descriptive labels appear in your legend and the table of contents.
9. Click OK.



Exercise 6: Symbolizing Layers



1. Right-click on the **geographic_place_names** layer. Click on the General tab.
2. Change the layer name to **Named Places**. This does not change the filename of the shapefile or feature class, it only creates an alias for the layer.
3. Click OK.
4. To save all changes made to the symbology, layer name, and labels a Layer file can be created.
5. Layer files always retain the data source of the shapefile. To save a layer file, right-click on the desired layer and select Save As Layer File.
   - ☐ Save the **Named Places** layer in **C:\Training\Data\Intro_to_ArcMap**.
   - ☐ Insert a new Data Frame (page A-17).
   - ☐ To determine the difference between a Layer file and a shapefile, we will add in one of each type and compare.
   - ☐ Using the Add Data tool, add in **geographic_named_places.shp** and **Named Places.lyr** from **C:\Training\Data\Intro_to_ArcMap.**
   - ☐ Both layers are using the same source of data. The layer file has also retained all of the layer customizations.

Exercise 7: Exporting Data & Making Maps

Background

ArcMap is the ArcGIS component that is designed to present spatial data information. Showing the results of your work is easy. You can make great-looking, publication-quality maps and create interactive displays that link reports, graphs, tables, drawings, photographs, and other elements to your data. You'll find that communicating geographically is a powerful way to inform and motivate others.

Goals

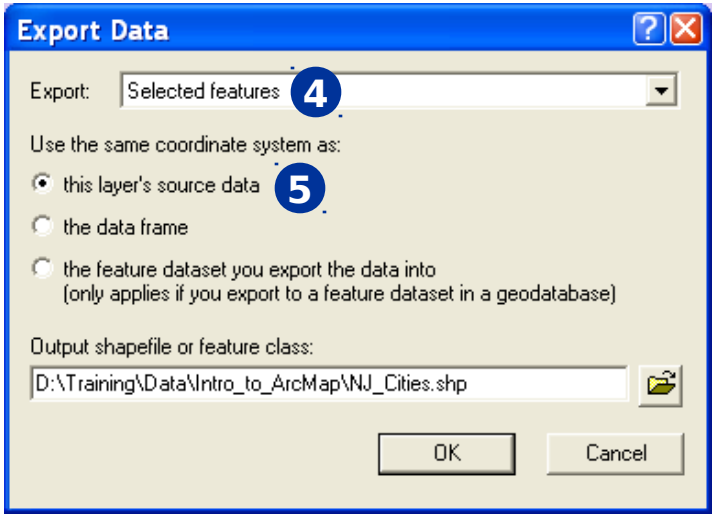
Displaying and distributing mapping data is a big part of GIS Mapping. After completing this exercise, the student will know the necessary steps to build a basic map and export data as shapefiles and images.

Objectives

1. The student will learn how to export data as a shapefile and export map layouts are images.
2. The student will learn how to create a new map layout and include the following components:
    1. North Arrow
    2. Scale bar
    3. Title/text
    4. Graphics
    5. Legends

Exercise 7: Exporting Data & Making Maps

1. Activate the **Layers** data frame.
2. To make a copy of an existing shapefile or feature class, or to create a shapefile that is a subset of a current shapefile, the export data utility can be used to extract a dataset.
3. In the ArcMap table of contents, right-click the layer and Select Data →Export Data.
   - ☐ Right-click on the **geographic_named_places** layer.
4. The Export Data dialog box opens.
5. Click the Export dropdown arrow and click All features or All features In View Extent.
   - ☐ For this example, we only want to export the NJ cities which are already selected in our view. Chose '**Selected features**' in the export selection box.
6. Click the appropriate button to either use the same coordinate system as the layer's data source or use the same coordinate system as the data frame.
   - ☐ Select '**this layer's source data**'
7. Click the Browse button and navigate to the destination folder for the output shapefile or feature class.
   - ☐ Browse to C:\Training\Data\Intro_to_ArcMap\ and name the shapefile Places.shp
8. Click OK.
9. A message appears asking if you want to add the shapefile to the current map.
10. Click Yes to include the output shapefile in the current map document, or click No to save it without including it on the map.
    - ☐ Click Yes to add the new shapefile into the Table of Contents.

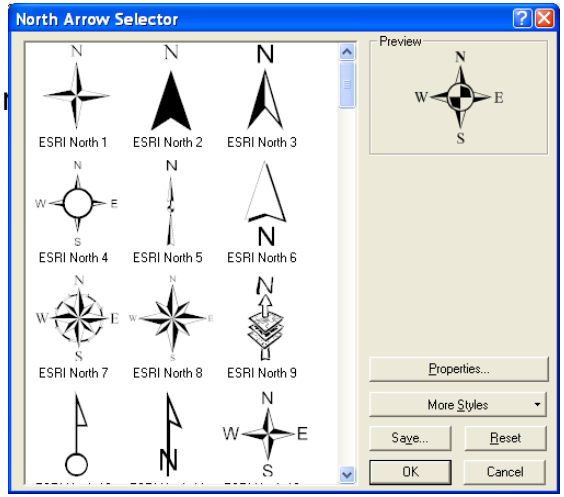


Exercise 7: Exporting Data & Making Maps

1. Switch to the Layout View, by selecting this option from the View men
2. This will automatically place your data frame into a map layout.

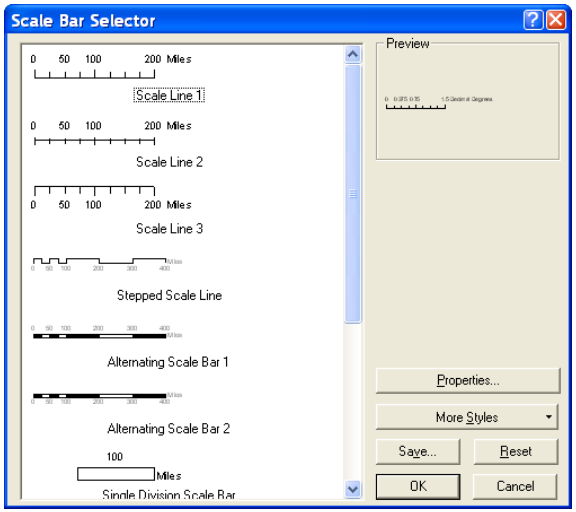
Adding a North arrow

1. Click the Insert menu and click North Arrow.
2. Click a North arrow.
   - ☐ Select you favorite North arrow style.
3. Click OK.
4. Click and drag the North arrow into place on your map.



Adding a scale bar

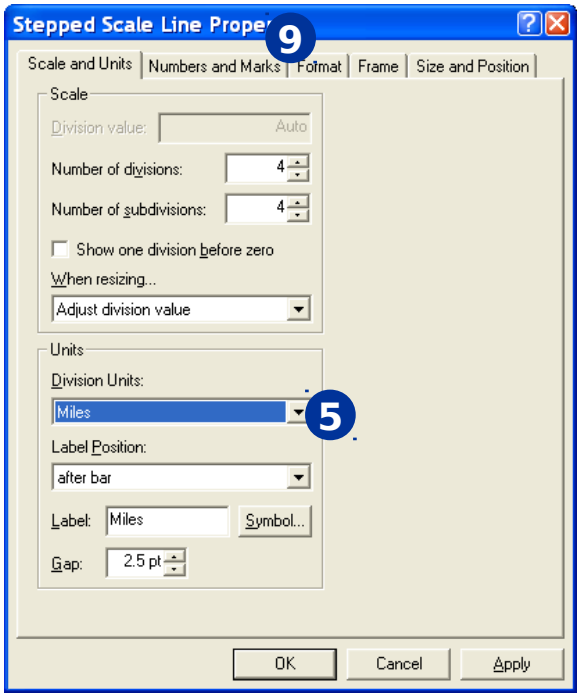
1. Click the Insert menu and click Scale Bar.
2. Click a scale bar.
   - ☐ Select you favorite scale bar style.
3. Optionally, click Properties to modify the scale bar's properties.
4. Click OK.
5. Click and drag the scale bar into place on your map.



Exercise 7: Exporting Data & Making Maps

Customizing a scale bar's scale and units

1. Right-click the scale bar and click Properties.
2. Click the Scale and Units tab.
3. Click the arrow buttons to set the number of divisions.
4. Click the arrow buttons to set the number of subdivisions.
5. Choose the units for the scale bar.
   - ☐ Change the Division Units to **Miles**.
6. Click Symbol and choose a text style for the scale bar labels.
7. Click OK.



Customizing a scale bar's numbers and marks

8. Right-click the scale bar and click Properties.
9. Click the Numbers and Marks tab.
10. Click the Numbers Frequency dropdown arrow to choose where along the bar to place the numbers.
11. Click the Numbers Position dropdown arrow to choose where to place numbers relative to the bar.
12. Click the Marks Frequency dropdown arrow to choose where along the bar to place tick marks.
13. Click the Marks Position dropdown arrow to choose where to place tic marks relative to the bar.
14. Click the Division Height arrow buttons to increase or decrease the height of division tick marks.
15. Click the Subdivision Height arrow buttons to increase or decrease the height of subdivision tick marks.
16. Click OK.

Exercise 7: Exporting Data & Making Maps

Adding scale text

1. Click the Insert menu and click Scale Text.
2. Click a sample of the style of scale text to add to the map.
3. Optionally, click Properties to customize the scale text.
4. Click OK.
5. Click and drag the scale text into position on your map.

Adding a legend

1. Click the Insert menu and click Legend.
2. The Legend Wizard appears. You can double-click this legend to change its properties. If you'd prefer to use the Legend Wizard when you insert a legend, you need to turn wizards back on. Click Options from the Tools menu and click the General tab in the dialog box that appears. Check the Show Wizards when available box.
3. To remove a legend item, click it, then click the left arrow button.
    1. Remove **oa19992000_landsat.jpg**
4. By default, all the layers on the map will appear as legend items in the legend.
5. Use the Up and Down arrow buttons to order the legend items.
6. Click Next.
7. Type a title for the legend.
8. Set the text color, font, and size as desired and click Next.
9. Click the Border dropdown arrow and click a border.
10. Click the Background dropdown arrow and click a background.
11. Click the Drop Shadow dropdown arrow and click a drop shadow.

Exercise 7: Exporting Data & Making Maps

12. Click Next.
13. Click a Legend Item in the list to modify the symbol patch.
14. Set the Patch properties as desired and click Next.
15. Set the spacing between legend elements by typing a value into the appropriate box.
16. Click Finish.

Changing the items in a legend

1. Right-click the legend on the map and click Properties.
2. Click the Items tab.
3. Click a legend item in the Legend Items list.
4. Click the up and down arrows to move the item up or down in the legend.
5. Click OK.

Adding a title

1. Click the Insert menu and click Title.
2. Click the Placement option you want.
   - ☐ Change the title to 'My First Map'

Adding a graphic element

1. Click the graphics dropdown arrow on the Drawing toolbar.
2. Click the New Rectangle button.
3. Click on the map and drag a box where you want the rectangle.
   - ☐ Drag the rectangle over the title.
4. The graphic element appears on the map.

Tip:
To change the font properties of any text elements on the map, use the tools available on the Drawing toolbar.

To add additional text elements to the mapping display, use the New Text tool to add a text box.

Exercise 7: Exporting Data & Making Maps

Placing a graphic element behind other elements

1. Click the graphic element to select it.
2. Right-click on the graphic element, point to Order, and click Send to Back.
   - ☐ Right-click on the newly created rectangle and send it to the back.

Applying color to a graphic element

1. Click a graphic element to select it.
   - ☐ Select the rectangle behind the title.
2. Click the Fill Color dropdown arrow.
3. Click a color.
4. The fill color is applied to the graphic element.

Applying a line color to a graphic element

1. Click a graphic element to select it.
   - ☐ Select the rectangle behind the title.
2. Click the Line Color dropdown arrow.
3. Click a color.
4. The line color is applied to the graphic element.
5. Click OK.

Exercise 7: Exporting Data & Making Maps

Adding a neatline

1. Click the Insert menu and click Neatline.
2. Click the Placement option you want.
3. Check Group neatline with elements if you want to group the elements with the neatline.
4. Click the Border dropdown arrow and click the type of neatline you want.

Navigating the map in Layout View

1. The Layout and Tools toolbars can both be used to navigate the view in your map layout.
2. When tools, such as Zoom In, Zoom Out, or Pan, are used from the Tools toolbar, the map extent and scale will change on the printed layout.
   - ☐ Zoom to the southern Oahu area. Notice out the layout changes.
3. If tools are chosen from the Layout toolbar, zoom will only be to the actual printed page and not the map

Exporting a map

1. Click File and click **Export Map**.
2. The Export dialog box opens.
3. Navigate to the folder where you want to store your image file, and choose the file format you want to use from the Save as type dropdown list.
4. Click Export to save the image file.